not appear mutually dependent, nor are they mutually exclusive. Whether raciation attains the species level depends upon the synchronous introduction of antipathetic responses between two or more merging races formerly spatially remote, an event that certainly is possible but, supported as it is by very few factual data, is probably atypical. Whether or not the species level is maintained depends largely upon the degree of fixation of an internal "awareness" whose sporadic involution in related associates may cause occasional anastomoses in the dichotomous tree of normally repellent, discrete evolution. Endless shifting circumstances, such as bring about sequestration, changing habits and locale, introduction of new faunistic elements, adoption of the parthenogenetic method of reproduction, etc., may mask the history of a species, its origin, deployment, and restriction, but so indelible is the nucleus of specific character that the relatively minor alterations due to change of life seldom, if ever, succeed in eradicating the stamp beyond recognition. All things considered, it is probably not too extreme a view to hold that sexual reproduction, together with at least initial association of divergent elements, is a *sine qua non* of the actual process of true speciation.

From the foregoing, two fundamental evolutionary principles suggest themselves: (1) True species may not be essentially dependent upon isolation for their origin; (2) secular isolation, though correlated with differentiation, may not by itself be a primary speciating factor. Speciation often appears to be the spontaneous introduction of new, self-insulating units within a parent-species population; it is the end product of self-augmenting, biogenic momenta involving the organism in its entirety. Typical raciation, on the other hand, is the effect on the species of group segregation, a factor imposed from without and operating disinterestedly in much the same manner as natural selection. To evaluate the mixed products of these two processes is the chief concern of taxonomy, a science whose complexity increases with the plasticity, youth, and colonizing drive of the group under consideration.

The scope of entomological taxonomy is so vast that the experimental approach to all its problems is out of the question. However, if good judgment based on carefully studied models takes the place of indiscriminate key-character hunting, great strides can be expected toward a system that will reflect evolution. A supposed new species should in every instance be subjected to a critical analysis, both as to the nature of its distinctions and as to the spatial relationships existing between it and its nearest allies. If these criteria were universally applied, systematics would gain immeasurably in significance, for it would then portray evolution in such a manner as to bring out not merely degrees of differences but *kinds* of differences as well.

GEOLOGY.—*The paleontology and stratigraphy of the upper Martinsburg formation of Massanutten Mountain, Virginia.*[1] MARK H. SECRIST and WILLIAM R. EVITT, The Johns Hopkins University. (Communicated by E. W. BERRY.)

During the course of field work on Silurian stratigraphy, Dr. Charles K. Swartz found what at first was thought to be a new species of the gastropod *Lophospira* in the upper part of the Ordovician Martinsburg formation in the Massanutten Mountain region of Virginia. In order to determine the significance of this fossil, Dr. Swartz approached the senior author, who has been engaged for some years in a study of the general problems concerning the stratigraphy and fauna of the Martinsburg, assisted, since the summer of 1941, by the junior author. As a result of this inquiry, a study was made not only of the section in which Dr. Swartz found the gastropod in question but also of another section somewhat farther south. The material collected has yielded ten new species of gastropods, pelecypods, and brachiopods. It has become evident that both the fauna and the lithology of the upper Martinsburg in these eastern sections indicate conditions different from those represented by the upper Martinsburg farther to the west and south.

[1] Received July 12, 1943.

Studies of intermediate regions are not sufficiently advanced to allow correlations between eastern and western areas to be included in this paper. We shall limit ourselves to a description of the new species and a statement of the evidence and conditions as they exist in the field and shall make definite correlations only between the two sections investigated in Massanutten Mountain.

Location and extent.—The area covered in this report lies in the Massanutten Mountain region of the Appalachian Valley Province of Virginia. This mountain is a large monadnock that projects from the floor of the Shenandoah Valley and extends about 50 miles in a northeast-southwest direction. The mountain itself is double, composed of two roughly parallel ridges, which are the limbs of a synclinal fold in the Paleozoic rocks, the more resistant formations of which have withstood to a greater degree the processes of erosion that have leveled the less resistant early Paleozoic limestones to form the broad, flat floor of the valley. The mountain divides this valley into a western part and an eastern part, which are occupied, respectively, by the North and South Forks of the Shenandoah River. New Market Gap, in Shenandoah and Page Counties, is the only large gap that cuts across the mountain, though several smaller gaps offer passage for unimproved country roads.

The outcrops studied occur in two localities: (1) along the road near the northern end of Passage Creek Valley in Warren County, extending for a distance of 710 feet (road distance) northward from the contact with the overlying Massanutten sandstone; and (2) about 40 miles to the south, along the Catharine Furnace Road on the north side of Cub Run in Page County, extending eastward 1,350 feet (road distance) from the contact with the Massanutten sandstone. Passage Creek drains the minor valley between the two ridges of Massanutten Mountain, having its headwaters north of New Market Gap. It flows northeastward and empties into the North Fork of the Shenandoah River east of Waterlick, just beyond the northern end of the mountain. Cub Run is a small stream flowing northward and eastward into the South Fork of the Shenandoah River a few miles south of Newport in Page County.

Underlying formation.—The Martinsburg formation, where observed in the Massanutten region, is underlain conformably by the Chambersburg limestone. In this section of Virginia we have recognized four lithologic divisions of the latter: (1) comparatively massive, impure limestone with several thin beds of bentonite near the base; (2) nodular, thin-bedded, argillaceous limestone; (3) a zone of blue limestone in beds 12 to 18 inches thick separated by thin beds of shale; followed gradationally by (4) the upper part of the formation, which, in the unweathered state, consists of compact, medium-bedded, impure limestone with numerous clay partings causing it to weather into thin sheetlike layers. The transition from this last zone into buff-weathering, preponderantly argillaceous lower Martinsburg is relatively abrupt. Zones (1) and (4) are well exposed at Cub Run, though at Passage Creek the entire Chambersburg formation is concealed. However, a complete section of the formation is exposed along Tumbling Run on the Lee Highway 2 miles southwest of Strasburg and about 5 miles west of Passage Creek.

Overlying formation.—The contact of the Martinsburg and the overlying Massanutten sandstone was not observed, but the concealed interval in which it occurs at both places amounts to only a few feet. The Massanutten formation is a massively bedded, white to gray sandstone and quartzite, conspicuously cross-bedded and very resistant, causing it to form prominent cliffs whose talus slopes invariably conceal the contact with the underlying Martinsburg. At Cub Run conglomerate beds with pebbles an inch or more in diameter are common. At Passage Creek the average grain size is much smaller. The contrast in the lithology of the two formations is everywhere a striking feature.

Regional and structural relationships.—A broad picture of the Martinsburg in the entire Massanutten Mountain area indicates that the upper part has experienced very little change, though the middle and lower portions have suffered both structural and

lithologic modification in the northern, northeastern, and western parts of the region. In the Cub Run section, on the contrary, very little alteration or deformation is evidenced.

An accurate determination of the thickness of the Martinsburg in the Massanutten region is impractical (see Butts, 1933, p. 21). Our measurements of sections farther west and south at Monterey Mountain, Catawba Mountain, Narrows, and McCalls Gap, for example, give thicknesses ranging from 1,400 to 2,200 feet. As a result of general field observations, we think the apparently much greater thickness in the Massanutten Mountain region is due to structural readjustments within the formation as visibly expressed by folding, faulting, and lithologic deformation.

Lithologic description of the Martinsburg formation.—In the Massanutten area, the Martinsburg formation is not exposed sufficiently for continuous investigation. At Passage Creek outcrops suitable for stratigraphic and faunal studies are restricted to the upper part of the formation. The lower part, where exposed, shows the results of structural and lithologic deformation. At Cub Run exposures are continuous from the massive Massanutten sandstone through the arenaceous upper Martinsburg and well down into the argillaceous middle portion, below which they are intermittent and of irregular extent into the underlying Chambersburg limestone. The following description is based largely upon the Cub Run section:

The gradation from the argillaceous limestone of the upper Chambersburg into the calcareous shale of the lower Martinsburg is fairly rapid. Weathering of the calcareous material results in a yellow to tan or buff color that is typical of the lower and middle portions of the formation. Ascending, the beds become increasingly argillaceous with the advent of arenaceous material in the middle portion. Toward the upper part of the latter, sandstone beds for the first time become prominently abundant. The gradation from the middle portion into the upper is marked lithologically by a change from dominantly argillaceous to dominantly arenaceous beds (Bassler, 1919, p. 156). Corresponding to this lithologic change occurs the faunal change described below.

As shown in the measured sections, the upper portion, characterized by an essentially Maysville fauna, consists mostly of brown, iron-stained, fine-grained sandstone beds of variable thickness with some shaly partings. Cross-bedding is rather general, especially toward the top. Much of the sandstone contains flakes of mica and hematite and flat inclusions of slaty shale up to an inch in size. In addition, being somewhat arkosic in nature, it has a speckled appearance.

Faunal description of the Martinsburg formation.—Investigators of these rocks have recognized a threefold faunal division, namely, (1) an essentially Trenton fauna in the lower part, (2) an Eden fauna in the middle part, and (3) a Maysville fauna in the upper part. Thorough investigations have been made in the classic Cincinnati area where the terms "Eden" and "Maysville" have become well established through long usage. In the Cincinnati area, the Trenton is recognized as a well-defined time and lithologic unit. As these formations are followed eastward, the distinctions between the Trenton and the Cincinnatian, on the one hand, and between the members of the Cincinnatian, on the other, become less marked. In large measure the three lose their individualities and more or less combine into a whole which is known to the east as the Martinsburg formation. Our studies in the western and southern parts of the Appalachian Province of Virginia and extending northward into Pennsylvania show that, on both lithologic and faunal grounds, several divisions of the Martinsburg exist, for which, tentatively, we are using the three classic terms "Trenton," "Eden," and "Maysville" (Bassler, 1919, p. 163), pending the results of more complete study.

Inasmuch as the purpose of this investigation was to establish the relationships and significance of the upper Martinsburg, a detailed study was not made of the middle and lower portions in the Massanutten region. At Passage Creek only the upper or Maysville part of the formation is available for study. At Cub Run, on the other hand, both the upper and a considerable thickness of

the middle or Eden portions are well exposed.

The following fossils, all well-recognized Eden representatives (Bassler, 1919, p. 169), establish the identity of the Eden portion at Cub Run: *Aspidopora* cf. A. *newberryi* (Nicholson), *Pholidops cincinnatiensis* Hall, *Sowerbyella sericeus* (Sowerby) var., *Hormotoma gracilis* (Hall), *Cryptolithus tesselatus* Green, and *Ceratopsis chambersi* Miller.

On the other hand, the Maysville at both Passage Creek and Cub Run is recognized not so much by individual species as by a general faunal assemblage (Bassler, 1919, p. 170), which includes species of the following:

BRACHIOPODS: *Dalmanella, Lingula, Orthorhynchula, Plectorthis, Rafinesquina, Zygospira.* PELECYPODS: *Byssonychia, Colpomya, Ctenodonta, Cuneamya, Cymatonota, Cyrtodonta, Ischyrodonta, Orthodesma, Pterinea, Rhytimya, Whitella.* GASTROPODS: *Liospira, Lophospira, Oxydiscus.* CEPHALOPODS: *Paractinoceras, Spyroceras.* TRILOBITES: *Calymene, Isotelus.* OSTRACOD: *Drepanella.*

In contrast to the Maysville of our western sections, there is evidence of only one distinct faunal zone at Passage Creek and Cub Run. Because of its excellent development at the former locality, we have called it the Passage Creek Zone. This zone, at both localities, may be recognized readily by the presence of several abundantly fossiliferous and conspicuously iron-stained horizons, which weather into a porous condition. In the foregoing fossil list of Maysville forms, the only genera that have not been found in the Passage Creek Zone are *Lingula* and *Oxydiscus.*

Very few and scattered fossils were found in the increasingly arenaceous beds of the upper portion above the Passage Creek Zone. Among these are the following: *Buthotrephis* cf. *flexuosa* Hall, *Palaeophycus* sp., *Lingula* sp.

The upper 96 feet of the exposed section at Cub Run have produced no fossils.

Discussion.—The Eden at Cub Run is comparable in lithology and fauna to the shaly Eden of the western sections. The general fossil representation in the Maysville, however, is meager; pelecypods and gastropods predominate with a relative scarcity of brachiopods and trilobites in contrast to their abundance in the argillaceous and calcareous material of comparable age farther west. The following, which are associated with the Maysville elsewhere, were not found at either of the Massanutten localities: *Platystrophia* sp., *Hebertella* sp., abundant Bryozoa, phosphatic masses (Butts, 1940, p. 208).

According to Butts (1933, p. 22), the Maysville is characterized "by the profuse and universal occurrence at the very top of *Orthorhynchula linneyi.*" Bassler (1919, pp. 168, 170), in contrast, states: "This *Ortho-*

CUB RUN SECTION

Thickness			Description
Total	Interval	Horizon	
—	—	242.1	Contact with Massanutten sandstone.
242.1	95.3	—	Barren, massively bedded sandstone, rust-stained and prominently jointed.
—	—	146.8	Highest bed containing plant remains.
—	—	129.2	*Lingula* cf. L. *nickelsi* Bassler.
146.8	36.9	—	Moderately cross-bedded, medium to fine-grained sandstone.
—	—	109.9	Highest gastropod (*Lophospira* sp. indet.).
—	—	90.7	Highest abundantly fossiliferous bed, 2 to 3 inches thick: argillaceous sandstone, weathering reddish brown (*Colpomya faba* cf. *C. pucilla* Foerste).
109.9	49.6	—	Shale beds becoming less frequent and thinner. Sandstone generally lighter in color. Cross-bedding more evident.
—	—	60.3	Highest Passage Creek fauna bed.
60.3	17.0	—	Passage Creek Zone consists of fossiliferous, rotten, rusty-brown lenses in and between heavier sandstone beds. *Lophospira, Rafinesquina,* and *Paractinoceras* abundant.
—	—	43.3	Lowest Passage Creek fauna bed.
43.3	11.0	—	Heavy sandstone beds: very little shale.
—	—	32.3	Very prominent spheroidal weathering in sandstone beds.
32.3	7.3	—	Heavy sandstone beds with shaly partings.
—	—	25.0	Lowest pelecypod bed (*Whitella massanuttenensis,* n. sp., and *W. nasuta,* n. sp., abundant).
25.0	15.7	—	Increase in thickness of sandstone beds. No fossils observed.
—	—	9.3	Highest typical Eden fauna, containing *Cryptolithus, Sowerbyella, Cornulites.*
9.3	9.3	—	A lithologic transition zone marked by an increase in sandstone.
0.0	0.0	0.0	Below this horizon is typical Eden lithology consisting of alternating light and dark beds of sandstone and shale, breaking into small, platy fragments. Eden thickness undetermined.

PASSAGE CREEK SECTION

Thickness			Description
Total	Interval	Horizon	
—	—	163.3	Lowest Massanutten sandstone outcrop taken as contact.
163.3	55.4	—	Entirely concealed, largely covered with Massanutten sandstone float.
—	—	107.9	Spring enclosure on west side of road containing highest Martinsburg outcrop.
107.9	12.9	—	Largely concealed, with a few scattered outcrops. Barren, fine-grained sandstone breaking into flat joint blocks.
—	—	95.0	Last fossils observed.
95.0	11.0	—	More or less massively bedded, fine-grained sandstone with a few thin beds containing Passage Creek assemblage.
84.0	8.0	—	Massive, fine-grained, gray to brown sandstone.
—	—	80.0	Extremely prolific 6-inch porous bed in which *Lophospira* is very abundant.
—	—	78.5	Very conspicuous porous bed.
76.0	6.0	—	A few thin porous beds with *Lophospira* abundant.
7.00	6.0	—	Massive sandstone with hematite particles and a few scattered *Rafinesquina* and pelecypods. Rusty weathering prominent.
64.0	10.0	—	Typical Passage Creek lithologic and faunal zone, containing frequent fossiliferous beds of variable thickness and extent, with *Paractinoceras*, then *Lophospira*, and then *Rafinesquina* conspicuous in ascending order.
—	—	54.0	At road level, beginning of more or less continuous exposures. Arkosic, fine-grained sandstone, thinly laminated throughout, weathering into blocky beds, speckled with hematite.
54.0	54.0	—	Concealed.
0.0	0.0	0.0	Lowest Martinsburg outcrop consisting of brown fine-grained sandstone beds, somewhat arkosic, weathering rusty. *Rafinesquina alternata mediolineata*, n. var., abundant; also *Dalmanella* sp.

rhynchula bed everywhere marks the dividing line between the Lower Maysville (Fairview) and the Upper Maysville (McMillan) divisions, the latter in the Appalachian region being an unfossiliferous, gray sandstone apparently of continental origin and equivalent to the Oswego sandstone of the New York section." In sections already examined elsewhere in the Appalachian region, we have found this *Orthorhynchula* zone usually well developed near the top of the formation (Bassler, 1919, p. 160). In the Massanutten region—specifically, in the Passage Creek section—one depauperate specimen of *O. linneyi* (James) was found. This occurred in the lower part of the Passage Creek Zone, which at the type locality is 106 feet, and at Cub Run about 200 feet, below the top of the Martinsburg.

This paucity of characteristic Maysville forms suggests striking differences in conditions of both environment and deposition between this area and those farther west.

Butts (1940, p. 202) reports the lack of other formations between the Martinsburg and the Massanutten in this region, and we have found neither Juniata nor Oswego beds as such in either of our sections. However, close examination of the Martinsburg of Little North Mountain, which lies between the western sections and Massanutten Mountain, may indicate whether the barren, somewhat cross-bedded, ferruginous sandstone beds lying above the fossiliferous part of the Passage Creek Zone are Martinsburg (Maysville) in age or are to be correlated with either the Oswego or the Juniata, or both, since these latter formations occur on Little North Mountain (Butts and Edmundson, 1939, p. 169). It is evident that the intermittent development of these intervening formations is a problem of such large scope that it is beyond the province of this paper to do more than note their apparent omission in the Massanutten syncline (Butts and Edmundson, 1939, p. 179).

In the two sections under discussion, variations in the lithology of the comparatively barren strata above the Passage Creek Zone suggest the possibility that they may have accumulated under deltaic conditions (Bassler, 1919, p. 161) with the source of the material closer to Cub Run than to Passage Creek. As evidence supporting this theory, the following observations are presented:

1. At Passage Creek the measured thickness of this zone is 68 feet, while at Cub Run it is almost three times as great, being 182 feet.

2. The sandstone beds contain scattered plant remains but no marine fossils.

3. As stated above, there is a striking absence of characteristic Maysville forms.

4. The material at Cub Run is more consistently arenaceous in character than that at Passage Creek.

5. There is a stronger development of cross-bedding at Cub Run than at Passage Creek.

6. At Cub Run the basal Massanutten is somewhat conglomeratic.

DESCRIPTION OF SPECIES

BRACHIOPODA

Rafinesquina alternata mediolineata, n. var.
Figs. 13, 14

All specimens are internal casts. Shell attaining large size, semioval, the average ratio of width to length for holotype and paratypes being about 1.4 to 1. Dimensions of holotype: width 36 mm, length 30 mm. Hinge line straight, equal to the greatest width of the valve. Cardinal angles rectangular to very slightly mucronate. Ventral valve gently and evenly convex, the beak moderately prominent; costellae small, rounded, and distinct, usually every fourth one more pronounced from the beak to the anterior margin. The pronounced costellae without bifurcations, but bifurcation of the smaller ones common in the anterior half of the valve. The outstanding surficial feature is a very prominent, straight, central costella extending the full length of the valve, but causing no extension of the anterior margin, which is evenly rounded. Faint concentric growth ridges indicated. Dorsal valve same as ventral valve in size and outline; flat, except for a very slight projection of the beak; finely and evenly costellate, lacking the alternations of the ventral valve.

Locality.—Passage Creek.

Remarks.—The varietal name *mediolineata* has been chosen because of the presence of the very conspicuous median striation on the ventral valve, which is lacking in *R. alternata* (Emmons). In other respects the two are similar.

This variety does not have the mucronate shape of *R. mucronata* Foerste; *R. squamula* James does not exhibit an alternation in the size of the costellae; *R. alternata centristriata* Ruedemann occurs much lower stratigraphically; and in *R. nasuta* (Conrad) the prominent central line is not a constant feature and the anterior margin is noticeably produced.

MOLLUSCA

PELECYPODA

Byssonychia bowmani, n. sp.
Figs. 4, 5

Cast of left valve. Shell small. Outline subquadrangular with rounded base. Beak small, rounded in section, acutely pointed, curving forward slightly and extending a short distance beyond the hingeline. Umbone very prominent, expanding evenly toward the entire ventral margin of the shell. Hinge line straight and about two-thirds the greatest length of the shell making an angle of approximately 90 degrees with the anterior margin. Height 32 mm; thickness 10 mm. Anterior outline about straight, the margin projecting slightly at its lower end to form the greatest length of the shell. From this point the ventral margin is strongly and convexly rounded, flattening somewhat as it approaches the posterior cardinal angle. Byssal opening indistinct. Costae fine, rounded, numbering from 65 to 70 and increasing very gradually in strength from the posterior to the anterior margins. Interior not seen.

Locality.—Passage Creek.

Remarks.—In outline this species is similar to *B. richmondensis* Ulrich, but in the latter the anterior margin is longer and the angle between the hinge line and the anterior margin is greater. Both *B. richmondensis* Ulrich and *B. praecursa* Ulrich are generally more elongate from beak to ventral margin. The specific characters of *B. bowmani* are the great number of costae (65 to 70, as compared with 38 to 42 for *B. precursa* and about 50 for *B. richmondensis*), a shorter anterior margin, and a less elongate shell.

This distinctive species is named in honor of Dr. Isaiah Bowman, president of The Johns Hopkins University.

Cuneamya umbonata, n. sp.
Fig. 8

Cast of the interior of right valve. Shell of medium size, having a length of 25 mm and a height of 15 mm, larger at the anterior end and tapering to a rounded posterior point; beak very large, high, pointed and incurved, projecting 2.5 mm above the cardinal line. Apex of beak situated about one-third the length from the anterior end. Cardinal line straight for one-

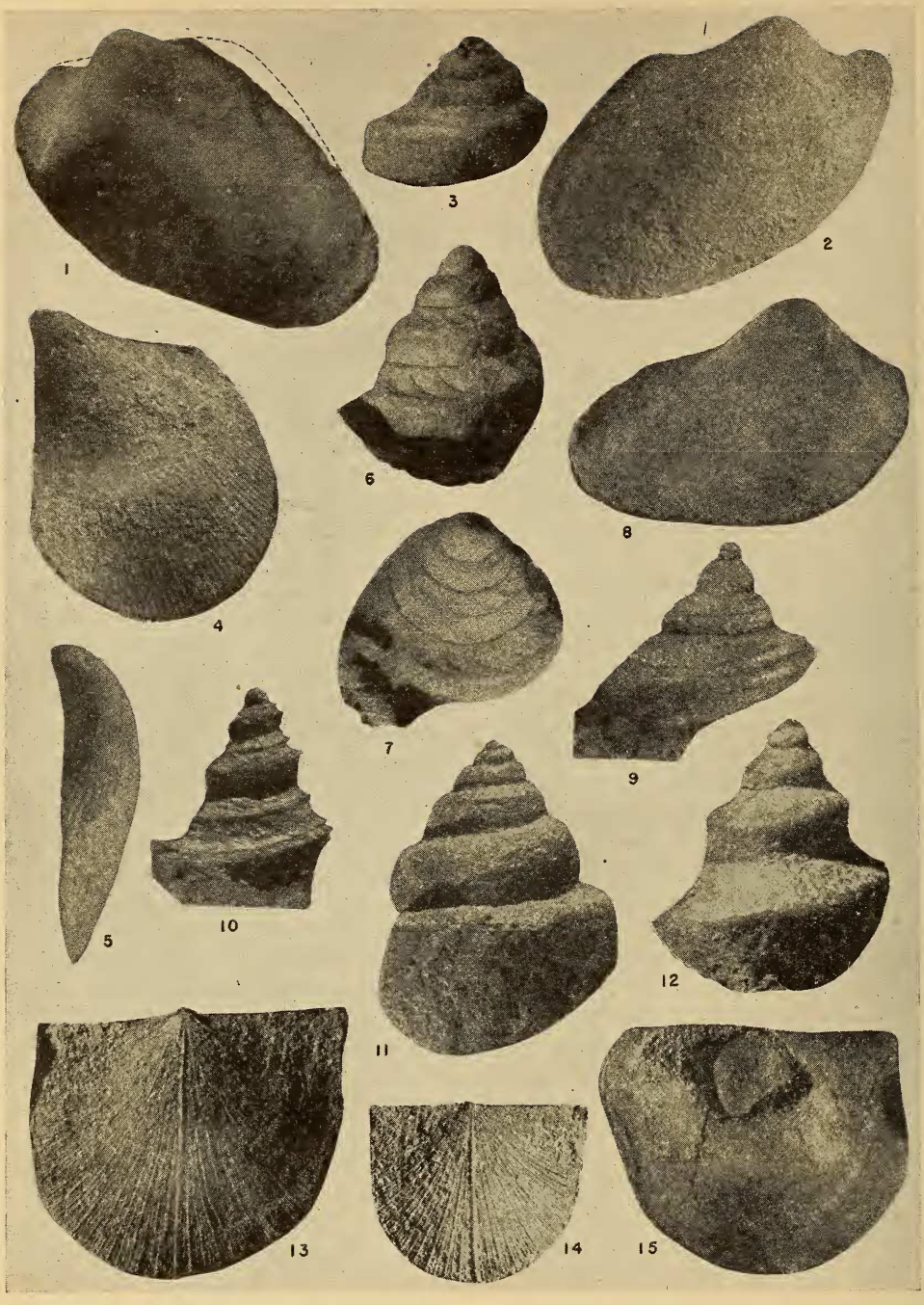

Fig. 1.—*Whitella massanuttenensis*, n. sp., cast of left valve of holotype. Fig. 2.—*W. nasuta*, n. sp., plastic cast of holotype, mold of right valve. Fig. 3.—*Lophospira expansa*, n. sp., cast of interior of holotype. Figs. 4, 5.—*Byssonychia bowmani*, n. sp., cast of left valve of holotype: 4, side view; 5, front view. Figs. 6, 7, 11.—*Lophospira tropidophora* (Meek), plastic casts of interior molds: 6, 7, two views of one specimen; 11, another specimen; all indicating common variations. Fig. 8.—*Cuneamya umbonata*, n. sp., cast of right valve of holotype. Fig. 9.—*Lophospira breviangulata*, n. sp., plastic cast of holotype, mold of interior. Fig. 10.—*L. trilineata*, n. sp., plastic cast of holotype, mold of exterior. Fig. 12.—*L. liosutura*, n. sp., plastic cast of holotype, mold of exterior. Figs. 13, 14.—*Rafinesquina alternata mediolineata*, n. var.: 13, holotype, external cast of ventral valve; 14, paratype, immature specimen. Fig. 15.—*Pterinea maternata*, n. sp., cast of left valve of holotype (umbone broken away, gastropod fragment lodged in opening).

All from Passage Creek except Fig. 2, which is from Cub Run.

half the length of the shell, posterior to the beak; posterior portion of the cardinal area slightly alate. Escutcheon well marked; lunule heart-shaped, distinct. Base of lunule forming anterior point of shell, the ventral margin curving convexly from this point to the posterior extremity. Umbonal ridge rounded, sloping to the posterior point. No trace of a sulcus, a horizontal longitudinal section being at no place concave. A line through the beak, through the widest part of the shell, makes an angle of about 20 degrees with the vertical. Greatest thickness of the valve 15 mm from which it tapers evenly and abruptly to the anterior, and gently to the posterior extremities. Faint concentric growth lines present.

Locality.—Passage Creek.

Remarks.—The striking prominence and convexity of the umbo distinguish this species from others of the genus.

Pterinea maternata, n. sp.
Fig. 15

Cast of left valve. Shell subrhomboidal, exceedingly convex. Hinge line straight, its length being 18 mm. Greatest length of shell 22 mm; height 20 mm; thickness 7 mm. Anterior wing short and broadly rounded. Posterior wing short, triangular, extending a little beyond the margin. Posterocardinal area alate. Beak destroyed. Umbonal ridge not marked, the whole valve having a swollen appearance. Posteroventral and ventral margins evenly rounded. Anterior margin nearly straight and making an angle, if extended, of about 75° with the hinge line.

Locality.—Passage Creek.

Remarks.—The most distinctive characteristic of this species is its striking convexity.

Whitella massanuttenensis, n. sp.
Fig. 1

Cast of left valve. Shell of medium size, very convex, subrhomboidal in outline, slightly the widest posteriorly; length measured from upper anterior to lower posterior angle 43 mm; greatest height 33 mm. Anterior margin gently rounded and nearly vertical in the upper half; sharply rounded at the extremity of the hinge. Ventral margin evenly and gently convex to the posterior extremity of the umbonal ridge. Postbasal angle strongly rounded. Posterior margin subparallel to the anterior margin, moderately rounded at the extremity of the hinge. Beak small and very prominent, not strongly incurved, situated about one-third to one-fourth the length behind the anterior extremity. Umbonal ridge very slightly developed as compared with the majority of the species of the genus. Sinus area slightly flattened in the ventral half of the shell, situated about midway in the length and subparallel to the umbonal ridge. Indications of imbricating and concentric growth lines present.

Locality.—Passage Creek.

Remarks.—*Whitella compressa* Ulrich is more rounded, compressed, and slightly more erect than this species. *W. obliquata* Ulrich has much stronger umbonal ridges with the beak situated more anteriorly. *W. ohioensis* Ulrich is more rounded in outline and less convex.

Whitella nasuta, n. sp.
Fig. 2

Mold of right valve. Shell medium, compressed convex, subrhomboidal in outline, elongate; length measured from upper anterior to lower posterior angle 43 mm; greatest height 28 mm. Widest at the posterocardinal angle. Hinge line almost straight. Anterior area flattened and produced into a rounded front margin. The ventral margin shows an evenly convex curve from the posterior extremity of the umbonal ridge to the anterocardinal angle. Posterior end of shell evenly rounded. Posterocardinal angle very wide. Umbone small, compressed, slightly incurved, protruding moderately above the hinge line. Umbonal ridge very low, disappearing in the posterior third. Umbone situated about one-third the length behind the anterior extremity.

Locality.—Cub Run.

Remarks.—This species bears a general resemblance to *W. massanuttenensis,* n. sp., but is distinguished by its nasute anterior end and more compressed shell.

GASTROPODA

Lophospira breviangulata, n. sp.
Fig. 9

Cast of interior. Apical angle 90°±. Height 8 mm. Volutions no more than 4. Probably tricarinate; all carinae rounded. Toward the aperture there is an indication of a lower carina which seems to fuse with the peripheral one higher in the shell. The upper carina is sepa-

rated from the peripheral one by a distinct but very narrow concave area, the position of which makes the upper slope of the whorl very wide and slightly convex. The last whorl is greatly expanded. Sutures well indented. Whorls compressed longitudinally. Umbilicus and aperture not seen; surface ornamentation obscure.

Locality.—Passage Creek.

Remarks.—This species is distinguished by the position of the upper carina which causes the slope between it and the suture to be unusually wide.

Lophospira expansa, n. sp.
Fig. 3

Cast of interior. Shell medium, volutions 4 to 5. Height 18 mm, diameter 16 mm. Apical angle about 90°. Whorls uniangular. Earlier whorls compressed and rounded, the upper slope being a little greater than the lower. Sutures moderately indented. Last whorl greatly expanded with a prominent rounded peripheral keel. Upper slope slightly concave and of such width as to be in striking contrast to the narrow and rounded surfaces of the earlier whorls which, exclusive of the last whorl, have an apical angle of about 75°. Lower surface of last whorl convex and sloping inward abruptly to the columella, giving the whorl a shallow or compressed appearance in relation to its comparatively great diameter. Surface markings indistinct.

Locality.—Passage Creek.

Remarks.—This species generally resembles *L. tropidophora* (Meek) but differs from it in the striking expansion of the last whorl.

Lophospira liosutura, n. sp.
Fig. 12

Mold of exterior. Apical angle about 50°. Volutions 5. Spire rather elongate. Height 13 mm, diameter of last whorl 9 mm. Peripheral carina prominent. Upper surface of the last whorl flat from the inner margin of the keel approximately to the suture. Inclination of this upper surface very steep. Upper surface of earlier whorls convex and steep. Lower surface of whorls very slightly convex, inclined very steeply, and fused with the upper surface of the next whorl to form a smooth, unbroken sutural curve.

Locality.—Passage Creek.

Remarks.—This species is distinguished by its smooth sutural curve and rather elongate spire. It compares only in general shape with *L. manitoulinensis* Foerste which is described from the Richmond of Ontario and Quebec. The latter, however, is much larger, having a height of 45 mm, and more closely resembles *L. sumnerensis* (Safford) and *L. tropidophora* (Meek) than does the present species.

Lophospira trilineata, n. sp.
Fig. 10

Mold of exterior. Apical angle 30° to 35°. Height 7 mm. Volutions 4; angular. Lower carina, if present, hidden. Central carina on the outer extremity of the volution very angular and prominent having on each side a sharp elevated ridge with a narrow groove between. These ridges are placed a short distance inward along the slopes from the keel, the distance being slightly greater for the upper one. Upper carina removed a third of the width of the slope from the upper suture, and very sharp or angular. Surface of whorl between the keels decidedly concave. There is a rounded ridge intermediate between the sharp upper carina and the suture. Umbilicus and aperture not seen. Surface ornamentation obscure.

Locality.—Passage Creek.

Remarks.—This species may be compared specifically with those Lophospiras which possess a threefold central carina. *L. trilineata* differs from these in possessing a small, rounded but prominent ridge on the last whorl between the upper carina and the suture. *L. saffordi* Ulrich apparently is more robust and much larger with seven volutions. *L. pulchella* Ulrich and Scofield also is larger. *L. bicincta* (Hall) possesses a much greater apical angle, thus having a shorter and fatter appearance.

Lophospira tropidophora (Meek)
Figs. 6, 7, 11

There is a notable lack of agreement between the description and illustrations of this form by Cumings (1907, p. 969) quoting from Meek (1872, p. 278), and those by Ulrich and Scofield, also following Meek (not Miller, see errata p. 1081 of reference). The description given by Ulrich and Scofield (1897, p. 978) follows:

"Height generally from 25 to 35 mm.; greatest width equalling from 75 to 80-100ths of the height; apical angle 75° to 80°. Volutions five, uniangular; base produced, rounded; umbilicus

closed; columellar lip thick and slightly twisted below. Surface markings curved strongly backward to the peripheral band, coarse and rather irregular on the base of the last whorl, much less distinct on the nearly flat upper slope. When perfect the lines of growth are somewhat lamellose."

Our specimens are in general agreement with the foregoing description, but the upper slope of their whorls is concave and the lower slope of the last whorl is more erect.

We have found a number of well-preserved casts of the interior of *L. tropidophora* and one moderately well-preserved cast of the exterior at Passage Creek. The descriptions follow:

Cast of exterior.—Shell large. Height 30 mm, width 25 mm. Apical angle 70 to 75°. Volutions 5 to 6. Last whorl very ventricose, the upper portion of the lower slope erect. Whorls uniangular, peripheral carina rounded, prominent and marginal. Upper slope concave; sutural edge distinct but not carinate; suture slightly impressed. On the earlier whorls, the ratio of upper slope to the lower is 2 or 3 to 1, giving a general pagodalike appearance to the shell. Growth lines on upper surface of the whorls are indistinct; on the lower surface of the last whorl they are very coarse, swinging slightly forward from the keel and then curving downward.

Cast of interior.—Last whorl very ventricose. The upper slope of the whorls comparatively narrow for the size of the shell; the ratio of its width to that of the lower slope for the last whorl being about 1 to 5. The upper slope is quite concave on the last whorl, less so on the earlier ones, and is crossed diagonally with backward-curving grooves. These are strongest in the midbreadth of the slope, disappearing toward the suture and the keel. The features of the upper slope show considerable variation. The main carina or keel is rounded with a slight edge on the upper surface and is situated a little inside of the greatest diameter of the whorl. The upper portion of the lower slope is comparatively erect and is the greatest diameter of the shell; the lower portion curves convexly inward. The earlier whorls are rounded and slightly compressed in appearance. There is no indication of a lower carina. The sutures are located at such a point that the ratio of the upper slope to the lower on the earlier whorls is about 1 to 1 or 1 to 1.5. Sutural edge slightly thickened but not carinate. The growth lines on the lower slope of the last whorl swing slightly forward from the keel and then curve downward. The lower portion of the inner lip is thickened and reflexed.

FOSSIL LIST FOR PASSAGE CREEK AND CUB RUN

Fossil	Passage Creek	Cub Run
PLANTAE		
Buthotrephis cf. *B. flexuosa* Hall		x
B. sp. indet.		x
Palaeophycus? sp. indet.		x
COELENTERATA—Graptozoa		
Diplograptus cf. *G. vespertinus* Ruedemann		+
D. sp. indet.	*	
ANNELIDA		
Cornulites cf. *flexuosus* (Hall)		+
BRYOZOA—Trepostomata		
Bythopora sp. indet.	*	*
Hallopora sp. indet.	*	*
BRACHIOPODA		
Dalmanella meeki Miller	*x	*x
D. multisecta Meek	*	*x
Lingula cf. *nicklesi* Bassler		x
Orthorhynchula cf. *O. linneyi* (James)	*	
Pholidops cincinnatiensis Hall		+
Plectorthis sp. indet.	*	+
Rafinsequina alternata mediolineata, n. var.	*x	*x
R. alternata (Emmons) var.		+
Sowerbyella sp.		+
Zygospira modesta (Hall)	*x	*+
MOLLUSCA—Pelecypoda		
Byssonychia bowmani, n. sp.	*x	x
B. praecursa Ulrich	*	x+
B. sp. indet.	*	*
Colpomya faba cf. var. *pucilla* Foerste		x
Ctenodonta albertina Ulrich	*	
Cuneamya scapha brevior Foerste	*	
C. umbonata, n. sp.	*	
Cymatonota cf. *pholadis* (Conrad)	*	
C. sp. indet.	*	
Cyrtodonta sp.	*	
Ischyrodonta unionoides (Meek)	*	*
I. sp. indet.		x
Orthodesma nasutum (Conrad)		x
O. sp.	*	
Pterinea insueta (Emmons)	*	x
P. maternata, n. sp.	*	
Rhytimya sp.	*	
Whitella massanuttenensis, n. sp.	*	x
W. nasuta, n. sp.		*
MOLLUSCA—Gastropoda		
Liospira vitruvia (Billings)	*	
Lophospira breviangulata, n. sp.	*	
L. expansa, n. sp.	*	
L. liosutura, n. sp.	*	
Lophospira medialis Ulrich and Scofield var.	*	
L. perangulata (Hall) var.	*	
L. trilineata n. sp.	*	
L. tropidophora (Meek)	*	*
Oxydiscus sp. indet.		x
MOLLUSCA—Cephalopoda		
Paractinoceras lamellosum (Hall)	*	*
Spyroceras sp. indet.	*	
ARTHROPODA—Trilobita		
Calymene sp. indet.	*	
Cryptolithus tesselatus Green		+
Isotelus maximus Locke	*	*
I. megistos Locke	*	
Odontopleura sp.		+
ARTHROPODA—Ostracoda		
Drepanella richardsoni (Miller) var.		*
Ceratopsis chambersi (Miller)		+

*=Passage Creek Zone.
+=Eden.
x=Maysville but not in Passage Creek Zone.

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BOTANY.—*A new plant of the genus* Onoseris *from Bolivia.*[1] S. F. BLAKE, Bureau of Plant Industry, Soils, and Agricultural Engineering.

The description of a new species of the composite genus *Onoseris* from Bolivia is published here in order to make the name available for a revision of the genus in course of preparation by Sr. Ramón Ferreyra, of the Estación Experimental de la Molina, Ministerio de Agricultura, Lima, Peru.

Onoseris fraterna Blake, sp. nov.

Herba valida trimetralis ubique compacte albido-tomentosa, faciebus superioribus foliorum exceptis; caulis striatus supra angulatus medullosus foliosus; folia maxima lyrato-pinnatifida, segmento terminali hastato-deltoideo cordato apice et in angulis acuto, lateralibus paucis oblongo-ovatis multo minoribus, basalibus pluribus minimis; panicula multicapitata pedalis et ultra ramis erectiusculis, pedicellis 1.5–6 cm longis prope apicem inconspicue subulato-bracteatis; capitula radiata ca. 42-flora 2.3 cm alta rubra; involucri 1.8–2 cm alti valde gradati ca. 7-seriati appressi albido-tomentosi phyllaria exteriora minima subulata bracteis apicis pedunculi omnino similia, cetera anguste oblongo-lanceolata ad lineari-lanceolata parum acuminata; corollae marginales 13 bilabiatae hermaphroditae antheris cassis, corollae interiores 29 tubulosae breviter 5-dentatae hermaphroditae; achenia breviter sericeo-pilosa; pappus stramineus.

"Herb 10 ft. high"; stem subterete, 1 cm thick, densely and compactly whitish-tomentose, solid, pithy; leaves (including the narrowly winged petiole) 57–64 cm long, submembranaceous, above bright green, sparsely and inconspicuously hispidulous with short conic hairs, beneath densely whitish-tomentose, the terminal segment 25–27 cm long, about 30 cm wide, repand-dentate with callous-tipped teeth, the lateral divisions about 2 pairs, 3–11 cm long, 2–5 cm wide, acute, repand-dentate, the segments toward base of petiole 7–9 pairs, triangular to linear, acuminate, 1.5 cm long or less; panicle about 50-headed, about 30 cm long and 24 cm wide, the axis and branches strongly angled, densely whitish-tomentose and puberulent with short, purplish, many-celled, not glandular hairs; subulate bracts toward tips of pedicels rather few and inconspicuous, 2–3 mm long, appressed; heads (moistened) campanulate-oblong, about 2.3 cm high, 1 cm thick; phyllaries rather persistently tomentose, more or less denudate on the often purplish margin and the broad median vitta, the latter often finely pilosulous with purplish hairs like those of the pedicels, the middle and inner phyllaries 1.8–2 mm wide; receptacle fimbrillate; marginal corollas crimson, 20 mm long, thinly pilose dorsally, the tubular part 10 mm long, the outer lip spreading, elliptic, 3-denticulate, 10 mm long, 2.5 mm wide, 8–9-nerved, the inner lip entire, narrowly linear, acuminate, revolute, 8 mm long; disk corollas crimson, tubular, cylindric, glabrous throughout, 17.5 mm long (tube 6.5 mm, throat isodiametric with tube, 9.5 mm, teeth 5, triangular, acute, erect, 1.5 mm long); achenes of ray and disk (scarcely mature) similar, subcylindric, 5-ribbed, densely pubescent with erectish hairs, 6 mm long; pappus copious, several-seriate, somewhat graduated, straw-color, of slender hispidulous bristles, 1.5 cm long; anthers of marginal flowers 4, nonpolliniferous, 4 mm long, those of the disk flowers 5,

[1] Received September 6, 1943.